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Determinants of postnatal depression in Sudanese women at 3 months postpartum: a cross-sectional study

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ABSTRACT

Objectives: Maternal mental health is a neglected issue in Sudanese healthcare. The aim of this study was to explore the factors associated with postnatal depression (PND) at 3 months postpartum in a sample of Sudanese women in Khartoum state.

Setting: Recruitment was from two major public antenatal care (ANC) clinics in two maternity teaching hospitals in Khartoum state. The study participants were recruited during their pregnancy and were followed up and screened for PND at 3 months postpartum using the Edinburgh Postnatal Depression Scale (EPDS).

Participants: A sample of 300 pregnant Sudanese women in their second or third trimester was included in the study. The inclusion criteria were Sudanese nationality, pregnancy in the second or third trimester and satisfactory contact information.

Outcome measures: PND was assessed using the EPDS at a cut-off score of ≥12. Maternal and sociodemographic factors of interest were illustrated in a directed acyclic graph (DAG) to identify which variables to adjust for in multivariate analyses and to show their type of effect on PND. A forward logistic regression model was built to assess the factors that are independently associated with PND.

Results: History of violence increased the odds of PND sevenfold, OR=7.4 (95% CI 1.9 to 27.6). Older age of mothers decreased the odds of PND by almost 20%, OR=0.82 (95% CI 0.73 to 0.92). Exclusive breast feeding and regular prenatal vitamins during pregnancy are associated with an 80% decrease in odds of PND, OR=0.2 (95% CI 0.06 to 0.70) and 0.17 (95% CI 0.06 to 0.5), respectively.

Conclusions: Factors associated with PND in this study are comparable to factors from other developing countries, although findings should be judged with caution owing to the high number of women who refused recruitment into the study.

INTRODUCTION

The WHO declared that one in four individuals will develop a mental or behavioural disorder during their lifetime, and that 20–40% of women in developing countries experience depression during pregnancy or after

Strengths and limitations of this study

- This was the first study in Sudan addressing maternal mental health by means of a screening tool (EPDS) that we validated in a Sudanese setting.
- Recruitment during pregnancy maximised follow-up and screening at 3 months postpartum.
- Our study assessed postnatal depression beyond the puerperal period (the period during which Sudanese women receive the most support after birth).
- We provided an interpretation on the type of effect each variable had on depression status using directed acyclic graphs (DAGs).
- A high number of women refused inclusion into the study.

childbirth.[1] The estimated average prevalence of perinatal mental disorders in the Eastern Mediterranean region (EMR) is 15–36%.[2] Women suffering from mental illness during pregnancy, specifically depression or psychosis, will have limited caregiving capabilities, thus leading to child neglect and future developmental and behavioural problems.[3]

Prevalence figures of postnatal depression (PND) are variable across different settings and cultures owing to variations in socioeconomic and gender-based determinants.[4] Research in low-income countries presented opposite points of view regarding this variation. Qualitative research illustrated that pregnant and postpartum women in low-income countries are protected from perinatal mental illness owing to the social construct and the 'traditional ritualised support' they receive during and after pregnancy. They suggest that this type of support is missing in higher-income countries.[5] In contrast, quantitative research in low-income countries continues to measure a similar or higher prevalence of PND compared with high-income countries. They suggest this is because of the environment in which women

are reproducing, an environment of 'depression-related risk factors'.[6] [7] They are living in circumstances of poverty, low educational level, early marriage, limited decision-making authority concerning reproductive autonomy, poor nutritional status and other gender-based stereotypical roles and responsibilities.[7] In a country such as Sudan, the amount of social support pregnant women receive is substantial; however, women are also living in a male-dominated society and in the middle of conflict situations, migration and deteriorating economic status, thereby making women highly susceptible to mental illness.[8] Hence, pregnancy-related mental health problems are expected to be higher among women in such settings.

Existing knowledge shows variations in the prevalence of PND among low-income countries despite comparably associated factors. In Ghana, the 1-month prevalence of PND is 3.8%, with antenatal depression and adverse birth outcomes as associated risk factors.[9] In the United Arab Emirates (UAE), 16.8% exhibited symptoms of PND at 2 months postpartum when screened with the Edinburgh Postnatal Depression Scale (EPDS). Antenatal depression, parity, religion and the use of formula for feeding are the significant risk factors.[10] In Lebanon, the prevalence of PND was 12.8% at 30–40 days after delivery, with a past history of depression being a significant risk factor.[11] In Uganda, the 3-month prevalence was as high as 43%, while associated risk factors were bad marital relations, mother's parity and infant characteristics.[12] In Upper Egypt, mothers screened for PND up to 1 year after birth had a high prevalence of 49%.[13] A low household income, child sleeping hours, complications after delivery and a lack of support from the husband after delivery were found to be statistically associated with PND.[13]

Caring for mothers with mental illness is neglected in healthcare systems in low-income countries, with Sudan being a prime example. This is because of the lack of understanding of the nature of maternal depression among women and among primary healthcare providers. In addition, the stigma associated with the condition prevents women from accessing mental healthcare. The neglect of maternal mental health issues could be an important reason that Sudan failed to reach its Millennium Development Goals (MDGs) of reducing maternal mortality ratio and the under-five mortality rate.[14] Accordingly, maternal mental health should be a research focus in Sudan. The prevalence of PND at 3 months after birth was reported from a previous analysis from this study by Khalifa et al[15] as 9.2%. Therefore, the aim of this analysis is to investigate factors associated with PND in the same cohort of Sudanese women.

METHODOLOGY
Study design
This was a cross-sectional study of 300 participants recruited during pregnancy with demographic data and contact information collected at recruitment. At 3 months after delivery, we screened 238 participants for PND with the EPDS at a cut-off score of ≥12. We also collected data on the proposed factors of associations (eg, obstetrical and medical complications during pregnancy or birth, place of delivery, regular uptake of vitamins during pregnancy, sex of the newborn, puerperal complications and circumstances after birth). The sample size was calculated using the prevalence of PND in Nigeria, a neighbouring African country with a similar social context to Sudan.[16] The prevalence of PND in Nigeria is comparable with the pooled prevalence of postpartum common mental disorders reported in 2012 by the WHO's systematic review of perinatal mental disorders from developing and underdeveloped countries.[6]

Women presenting at two antenatal clinics in two major public tertiary hospitals were invited to participate in the study, and the hospitals chosen were Omdurman Maternity Teaching Hospital (90% of total sample) and Ibrahim Malik Teaching Hospital (10% of the sample). Khartoum state has the highest level of utilisation of antenatal care (ANC) services in Sudan and the highest level of institutionally based deliveries as well.[17] ANC attendance in Khartoum state is 88%,[17] which indicates the proportion of women who attend 'at least one' ANC visit with a skilled provider during a pregnancy. Women from all localities of Khartoum state can access ANC services in Omdurman Maternity Hospital because access does not depend on the location of residence.[18] The inclusion criteria were women of Sudanese nationality residing in Khartoum state, in the second or third trimester, of any parity and with full contact information (at least two working telephone numbers). Illiteracy was not an exclusion criterion as data collection was via interviews.

Procedure
Recruitment was intermittent during the period from April 2013 to April 2014. Hospital records showed that almost 5000 women attended the clinics during that year. We approached candidates after the completion of their physical examination. The examining physician introduced the principal investigator to each candidate, and we approached and assessed 700 pregnant women for eligibility (figure 1). Two hundred women were excluded owing to insufficient contact information (unavailability of mobile or home phone numbers), a non-Sudanese nationality and being in their first trimester. Among the 500 women who satisfied inclusion criteria, 200 refused to participate in the study. The final sample for follow-up was 300 (60%), that is, the first interview (T0). A total of 238 women completed the follow-up at 3 months postpartum, that is, the second interview (T1). Last, no information was available for us on the 200 women that refused participation into the study.

First interview (T0, n=300)
Information was collected at recruitment on sociodemographic data, as full contact information was obtained at
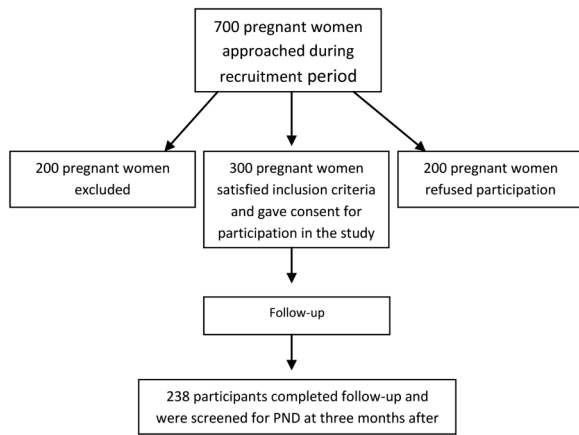
Figure 1 Flow chart of the number of participants in the study.

that time to secure follow-up and screening for PND after delivery.

Second interview (T1, n=238)

At 3 months, 238 participants were screened for PND with the EPDS.[15] Interviews were done either face-to-face or through phone interviews. Phone interviews were conducted to minimise the loss of follow-up only when women were away from Khartoum state or refused home visits. As reported from a previous analysis in the same study,[15] the follow-up rate at 3 months postpartum was 79%. Moreover, the loss to follow-up was due to personal refusal (4.7%), the husband's refusal (4.7%) and contact failure (11.3%). Participants who lost to follow-up were not significantly different from women who completed the follow-up in age (the mean age was 27 and 28 years, respectively), in parity (the median parity was 1.9 children and 1.8 children, respectively) or in educational level (Pearson χ^2 p value=0.705).

Measures
The Edinburgh Postnatal Depression Scale

The EPDS is a reliable and validated screening tool for PND developed for use at the primary healthcare level[19] and has been translated and validated into 57 languages, including Arabic.[20] It is a screening test consisting of 10 inventory questions that investigate feelings occurring within the previous 7 days with each question having 4 possible answers rated from 0 to 3. A woman is considered 'test positive' for PND if she scores 12 or more out of 30 as set by Cox *et al*.[19] The tool was originally designed to be self-administered, but studies have shown that screening through directed interviews is an equivalent screening technique.[21] Ghubash *et al*, the first authors to translate the EPDS into the Arabic language, stated that EPDS had a Cronbach's coefficient of 0.84. In the current study, the Cronbach's coefficient of the EPDS is 0.83.

Determinants of interest

In addition to sociodemographic information, data on certain variables of interest were collected. Data were collected on the history of any psychological condition, history of violence, place of stay after birth, supportive person after birth, newborn gender and characteristics, complication during pregnancy and birth, planning of current pregnancy, regular uptake of prenatal vitamins, breastfeeding practices, circumstances during and after pregnancy and satisfaction with current quality of life.

Statistical analysis

The analysis in this article was done after validation of the EPDS screening tool on the same sample. We constructed an initial directed acyclic graph (DAG) for a number of variables of interest (see figure 2). The aim of the analysis was to investigate multiple independent associations with PND using logistic regression. Crude measures of association between each variable and PND were first analysed by χ^2/t tests and Mantel–Haenszel (crude) ORs. A multivariable regression model was then built using a forward regression selection approach. The variable with the smallest overall p value from the crude analysis was selected first and incorporated into the model. Next, each variable was included in the model in turn and a likelihood ratio test (LRT) was performed. The process was repeated until only variables with p>0.05 remained. The model was based on complete observations on all variables of interest, and interaction between the final variables in the model was also tested. A DAG was drawn with the model variables to interpret the type of effect each variable has on PND.

RESULTS

Out of 238 women included in the present study, we have reported in a previous validation study that 22 women screened positive for PND with the EPDS at a cut-off point of ≥12, thus resulting in a prevalence of 9.2%.[15] About 12% of study participants held an occupation at the time of recruitment. The majority of recruited women (72%) were unemployed with no history of employment, 10% had an occupation before marriage and 6% were students. About 2% had no formal education (illiterate), whereas 39% had university and/or postgraduate education. The mean age of participants was 28 years, with 41% between the ages of 15 and 25. Current pregnancy was unplanned in 35% of women, 6% had home deliveries, almost 40% delivered by caesarean section and 8% were in a polygamous marriage. Table 1 illustrates descriptive statistics of women screened for PND at 3 months postpartum (test positive vs test negative women) at a prevalence of 9.2%.

Significant factors by univariable analysis

A univariable analysis revealed that 10 variables are associated with PND using χ^2 tests (for categorical variables) and t tests (for continuous variables) at a significance

Figure 2 A DAG of the factors of interest in the analysis. DAG, directed acyclic graph.
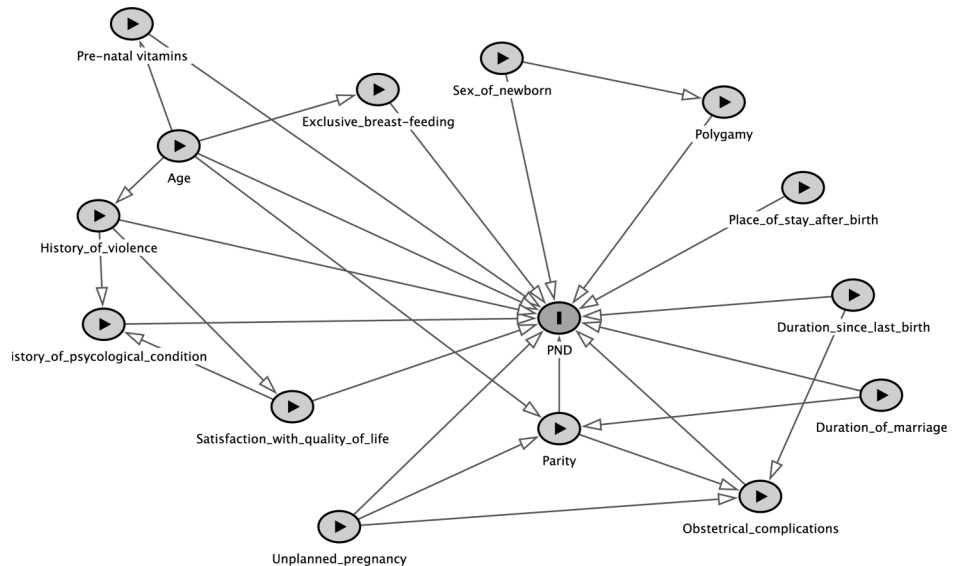
level of 0.05 (table 1). The analysis showed no significant relationships between PND and any obstetrical complications and most sociodemographic variables. Also, newborn sex and characteristics were not associated with PND. Variables increasing the odds of depression were younger maternal age, shorter duration of marriage, previous history of a psychological condition, history of violence/stress and dissatisfaction with living conditions. Factors reducing the odds of PND were exclusive breast feeding, regular prenatal vitamins during pregnancy (regular uptake for at least two trimesters), higher parity, longer duration since last birth and place of stay during puerperium (family home vs own home). Table 2 illustrates the crude ORs of variables significantly associated with PND.

The forward regression selection model building approach resulted in four factors independently associated with PND: age in years, history of violence, exclusive breast feeding and regular prenatal vitamins (table 3). Models with and without interaction terms were compared. Interaction was not significant at the 5% level, and proportional odds were assumed in the final model. Figure 3 illustrates the DAG of the variables in the final regression model.

Effects of factors independently associated with PND

Violence is associated with PND irrespective of the age of the woman. Women who suffered domestic violence before or during pregnancy have a sevenfold increase in the odds of depression at 3 months postpartum, whereas women who took prenatal vitamins for at least two trimesters during pregnancy have more than 80% less odds of PND irrespective of their age. Exclusive breast feeding for the first 3 months drops the odds of PND by 80%. A younger age for women is associated with PND, and an increase in age of a woman decreases her odds by almost 20% per year. The effect of age on the odds of

PND is a direct effect that does not pass through any of the mediators in the DAG. The effect of a 'history of violence', 'exclusive breast feeding' and 'prenatal vitamins' is the same across all pathways; hence, their effect on PND is a total effect.

DISCUSSION AND RECOMMENDATIONS

According to the literature, the peak time for PND is 6–8 weeks, but we hypothesised that PND among Sudanese women is more likely to peak after that period owing to the care and support they receive during puerperium from their families and communities. Postpartum women across different cultures and socioeconomic backgrounds are susceptible to PND which suggests a diversity in determinants.[4] More than 70 predictors of PND are reported in developing countries.[4] The strongest determinant for PND in this study, a 'history of violence', has been highlighted in individual studies and in systematic reviews as one of the strongest predictors of PND.[22–25] These studies have stated that there is 'consistency in the reporting of domestic violence among depressed mothers across cross-sectional studies'.[22] There are no published estimates on gender-based or domestic violence in Sudan. Several studies have documented younger maternal age and first pregnancy as determinants of PND, particularly among adolescent mothers.[26 27] The percentage of girls between the ages of 15 and 19 who had at least one child in Khartoum state in 2010 is 10%,[17] with the figure reaching 30% in Darfur states.[17] Consequently, younger mothers and primigravidas should receive support and quality ANC to detect those at risk of PND.

Participants had lesser odds of PND when they exclusively breast fed for 3 months after birth. Studies have highlighted that breastfeeding mothers continue to score lower in depression screening tests.[28 29] Attitudes

Table 1 Characteristics of the women screened for postnatal depression* at 3 months postpartum (n=238)

Variable	N	Test positive (EDPS≥12)	Test negative (EPDS≤12)	p Value
EPDS (mean=4.4, SD=4.6)	238	22 (mean=15.4, SD=3.0)	216 (mean=3.3 SD=2.9)	<0.001
Age group (mean=28, SD=5.5)				
Less than 19	8	2 (9.1%)	6 (2.8%)	0.00
20–29	136	18 (81.8%)	118 (54.6%)	
More than 30	94	2 (9.1%)	92 (42.6%)	
Educational level				
University and above	93	9 (40.9%)	84 (38.9%)	0.81
Secondary	66	5 (22.7%)	61 (28.2%)	
Primary	74	8 (36.4%)	66 (30.6%)	
No education	5	0 (0%)	5 (2.3%)	
Occupational status				
Never employed	167	12 (54.5%)	155 (71.8%)	0.05
Currently employed	34	2 (9.1%)	32 (14.8%)	
Previously employed	25	4 (18.2%)	21 (9.7%)	
Current student	12	4 (18.2%)	8 (3.7%)	
Parity				
Primigravida	59	10 (45.5%)	49 (22.7%)	0.03
Multigravida (1–4)	158	12 (54.5%)	146 (67.6%)	
Grand multipra (>4)	21	0 (0.0%)	21 (9.7%)	
Polygamy				
Yes	19	4 (18.2%)	15 (6.9%)	0.10
No	219	18 (81.8%)	201 (93.1%)	
Complications during or after pregnancy				
Yes	87	11 (50.0%)	76 (35.2%)	0.17
No	151	11 (50.0%)	140 (64.8%)	
Presence of chronic illness				
Yes	42	4 (18.2%)	38 (17.6%)	0.94
No	196	18 (81.8%)	178 (82.2%)	
Place of delivery				
Health facility	220	22 (100%)	198 (91.7%)	0.06
Home	18	0 (0.0%)	18 (8.3%)	
Sex of newborn†				
Male(s)	136	15 (68.2%)	121 (57.1%)	0.31
Female(s)	98	7 (31.8%)	91 (42.9%)	
Type of delivery				
Vaginal delivery	148	13 (59.1%)	135 (62.5%)	0.95
EmC/S	29	3 (13.6%)	26 (12.0%)	
Elective C/S	61	6 (27.3%)	55 (25.5%)	

p Value from χ^2 analysis for categorical variables or t test for continuous variables.
*Screening was by the EPDS at a cut-off score ≥12.
†n=234 (four women had abortions or miscarriages).
EmC/S, emergency caesarean section; EPDS, Edinburgh Postnatal Depression Scale.

towards breast feeding in Sudanese culture are quite favourable, and it is highly prevalent in Sudan that mothers exclusively breast feed for up to 4 months (70%).[30] Mothers who do not introduce formula feeding are highly praised in their communities, whereas mothers who do are criticised. The criticism of new mothers on their caring practices could heighten feelings of anxiety or depression. Another factor associated with lower odds of PND in this study was being on regular prenatal vitamins during pregnancy (for at least two trimesters in the form of folic acid and iron supplements). Women attending routine ANC in Sudan are prescribed 'Fefol', an iron and folic acid containing vitamin, as a prophylaxis for iron and folic acid deficiency anaemia during pregnancy irrespective of their blood haemoglobin level. A lower haemoglobin level is documented as a physiological factor associated with PND in a number of studies,[31–36] and it is proposed that the role of iron in thyroid hormone metabolism and in the function of inflammatory cytokines might be the underlying cause of depression.[37 38] In this study, haemoglobin levels were not measured. Moreover, the prevalence of iron deficiency anaemia among pregnant Sudanese women in Khartoum state is more than 30%,[39] thereby indicating the possibility that a significant proportion of the women in the study could be anaemic, and that the routine supplementation with Fefol vitamins during pregnancy reduces the odds of PND.

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Table 2 Univariable analysis of 238 screened women (22 women test positive, 216 women test negative)

Variable	Screening status		Crude OR (95% CI)	p Value *
	Test positive	Test negative		
Age (years) (mean, SD)†	24.1 (3.7)	28.7 (5.6)	0.84 (0.76 to 0.09)	<0.001
Duration of marriage (years) (mean, SD)†	2.7 (3.6)	6.7 (5.7)	0.47 (0.31 to 0.73)	<0.001
Regular prenatal vitamins				
Yes	8	163	0.19 (0.07 to 0.48)	<0.001
No	14	53		
History of violence (domestic/marital)				
Yes	6	15	5.02 (1.71 to 14.72)	0.00
No	16	201		
History of a psychological condition				
Yes	2	14	4.24 (1.36 to 13.20)	0.01
No	17	202		
Duration since last birth (years) (mean, SD)†	2.26 (1.9)	3.34 (2.0)	0.18 (0.04 to 0.76)	0.02
Parity (median, IQR)†	1 (2)	2 (3)	0.53 (0.30 to 0.93)	0.03
Exclusive breast feeding				
Yes	15	183	0.34 (0.12 to 0.96)	0.04
No (mixed/formula)	6	25		
Place of stay after delivery				
Family home	16	108	0.37 (0.14 to 0.99)	0.05
Own home (ref)	6	108		
Satisfaction with quality of life				
Dissatisfied	3	10	4.16 (1.03 to 16.85)	0.05
Neither	5	12	5.77 (1.78 to 18.71)	0.00
Satisfied (ref)	14	194		

*p Values from χ^2 test of significance.
†Analysed as continuous variables.

Some important variables hypothesised to be associated with PND among Sudanese women before analysis were not significant after analysis (see figure 2), including 'male gender preference' and 'unplanned pregnancy'. Women giving birth to female newborns are criticised and blamed by their husbands and family members in various cultures in China, Japan, India and Turkey.[40–44] Unplanned pregnancy was reported as a factor associated with PND in Indonesia and Pakistan.[45 46] Although the uptake of family planning in Sudan is low (10%),[17] 'unplanned pregnancy' remains a factor not associated with PND. It could be construed

that Sudanese culture encourages procreation and the creation of larger families.

Socioeconomic deprivation variables such as a low educational level and unemployment were not associated with PND in our sample. This coincides with existing evidence which states socioeconomic variables play a small role in developing PND.[47] Furthermore, similar to studies from other populations, obstetrical and newborn complications were not associated with PND at any level of this analysis.[47] The absence of important determinants in a population is an important finding in itself, as it assists in tailoring interventions for maternal mental health.

Table 3 Crude and adjusted effects of the variables in the logistic regression model (n=238)*

Variable	Unadjusted effect (OR)	95% CI	Adjusted effect (OR)	95% CI	Type of effect†
Age (years)	0.84	(0.76 to 0.09)	0.82‡	(0.73 to 0.92)	Direct
History of violence	5.02	(1.71 to 14.72)	7.40§	(1.90 to 27.60)	Total
Exclusive breast feeding	0.34	(0.12 to 0.96)	0.20§	(0.06 to 0.70)	Total
Regular prenatal vitamins	0.19	(0.07 to 0.48)	0.17§	(0.06 to 0.50)	Total

*Interactions between the variables in the model were tested and found insignificant.
†According to the DAG.
‡Adjusted for history of violence, exclusive breast feeding and regular prenatal vitamins to give a direct effect of age on PND according to the DAG.
§Adjusted for age in years according to the DAG.
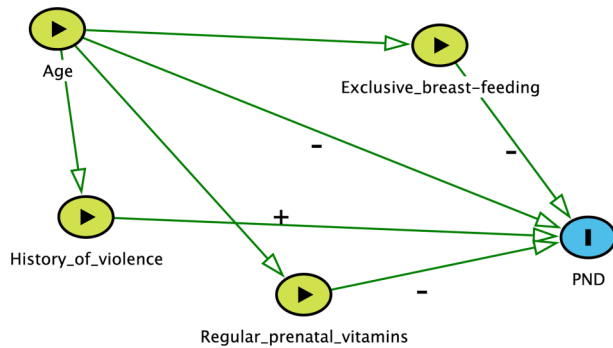DAG, directed acyclic graph; PND, postnatal depression.

Figure 3 A DAG of the factors associated with PND from the logistic regression model. DAG, directed acyclic graph; PND, postnatal depression.

Sudan did not reach its target indicators in child and maternal health, which could be because of issues not addressed by the Sudanese health system, such as maternal mental health. Efforts to develop evidence-based policies to address maternal mental health in Sudan are highly needed, since there is global evidence of the long-term economic costs to neglecting maternal mental health. Nonetheless, there is evidence on the feasibility and acceptability of screening for PND in low-resource settings, especially with higher cut-off points that result in higher specificity and lower false-positive rates (A Bauer, M Parsonage, M Knapp, *et al*. The costs of perinatal mental health problems. Unpublished 2014).[48] At low-resource settings, such as in Sudan, screening at higher cut-off points decreases the number of women requiring diagnosis by clinical examination. Clear guidelines for detection, referral and treatment of prenatal and postnatal women are needed. The early identification of 'at-risk mothers', that is, young mothers, primigravidas and women in abusive relationships, is a priority so that timely tailored counselling and treatment can be initiated. Awareness raising among Sudanese women on the mental stages that females pass through during their reproductive lives is crucial, along with awareness raising on the benefits and safety of certain medical treatments for depression during breast feeding.[49] Community-based health promotion programmes could accomplish this, and we also need capacity building for healthcare personnel, particularly for those working at the community level, to remove organisational barriers to maternal mental health.

Strengths and limitations

This was the first study in Sudan addressing PND. However, measurement error of some variables is expected. Women under-report their subjection to violence, which may have underestimated the association between PND and domestic violence. Additionally, the 'history of a psychological condition' could have been under-reported. The protective effect of taking prenatal vitamins in this study is an important finding that needs

further research. Owing to the acceptable follow-up rate in our sample (79.3%), as well as the non-significant differences between women followed and women lost to follow-up,[15] threats to the internal validity of this analysis are minimal.

The results of this study are at risk of bias owing to the large number of women who refused participation. Hence, this bias may have overestimated, or underestimated, the results. In spite of a high refusal rate that threatens the external validity of the results, we consider our sample to be representative of women in Khartoum state because we recruited study subjects from the highest utilised maternity hospital. In addition, parity and educational level estimates from our sample are comparable with state estimates from the latest Sudan census and household survey.[17 50] On the other hand, sociodemographic features of women in Khartoum are different from other states; therefore, the results from this study are not generalisable to all of Sudan.

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